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the people of NPA

A Pilot Study

Automation: Its Impact on Business and Labor

by John Diebold

President, Diebold & Associates, Inc.

The following article is a partial text of the NPA study, Automation: Its Impact on Business and Labor, *published May, 1959.*

IN THE LATE eighteenth century, a young inventor named Oliver Evans built an automatic flour mill near Philadelphia. Evans' mill processed grain into flour without any human intervention from the time the grain was dumped into a hopper at the beginning of the milling operation until it emerged as finished flour, packed in barrels, at the end. By 1813 millers were pleading before Congress for "relief from the oppressive operations" of Evans' patent, and Thomas Jefferson was called on for advice. Jefferson dismissed the whole thing as an old story. "The elevator," he said, after inspecting the mill, "is nothing more than the old Persian wheel of Egypt, and the conveyor is the same thing as the screw of Archimedes."

Confronted with the phenomenon of automation today, modern observers are as sharply divided in their attitudes as were Jefferson and the millers. Automation is "just more of the kind of stuff which has been taking work out of work, and creating more and better jobs all the time," said Dr. Cledo Brunetti at the time he was Director of Engineering Research and Development at General Mills, and he cited Neanderthal man's club as the first example of automation.

Unquestionably, industrial progress began hundreds of years ago. Great strides were made in the industrial revolution of the eighteenth century. This was the period of mechanization. Mechanization provided power-driven tools, eliminating many manual tasks and freeing labor from much of the physical work required in production. But no matter how small a portion of brute strength was involved in running a machine, a human worker was always needed to operate and control it. Production processes, therefore, were necessarily designed around the human worker as operator.

Now, through systematic application of the principle called feedback, machines can be built which control their own operations, so that production processes do not have to be designed to take into account the human limitations of a human worker. To me, this is one of the distinctive facts about automation. Also, for the

Freedom Is Indivisible

● "Free enterprise has evolved over the ages out of the experience of millions of individuals. They have concentrated, each in his own fashion, on devising, producing and selling goods and services, each seeking rewards for his efforts in providing the means of better living for more and more people.

"The private businessman has not seen the need to develop a formal creed, nor to explain or justify his system. But in our times collectivist economic systems have been brought forward. They are the product of intellectual theory based on elaborate dogma with highly developed dialectics. Their proponents are tireless in their arguments and propaganda, which are persuasive to many people.

"Faced with this condition, private business now is realizing that it must learn to explain and justify itself intellectually as well as through its actions.

"The freedom to acquire and own property is one of the essential freedoms of man. History, I believe, shows clearly that where the individual had no right to own and manage property, he has likewise had no other freedoms—freedom of speech, of press, of religion, of assembly, and of living as an individual. Today, history repeats itself. In those lands where man is not free to own property and to choose his vocation he does not enjoy those other freedoms.

"We must remember that freedom is indivisible."

From a foreword by Robert L. Garner, President of the International Finance Corporation, to Private Enterprise in Economic Growth, *a publication of a panel discussion held at the Second Annual Meeting of the Board of Governors, International Finance Corporation, New Delhi, India, October 8, 1958.*

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first time, it is practical to look at an entire production or information-handling process as an integrated system and not as a series of individual steps. It is through the new technology of automation that we are now beginning to possess the ability and the tools to build such systems.

Automation has made its chief impact so far on three major kinds of operations: the manufacturing of discrete units of product, the processing of bulk materials, and office work. It should be noted that these are different fields, and that the particular techniques and hardware, as well as the particular problems posed by automation, will have widely differing variations. But a common philosophy—a concern with the production process as a system and a striving for a better level of control within that system—marks them all.

In this country the packaging and bottling industries have long since achieved automatic production. In this field, automatic production processes were a natural outgrowth of mechanization and assembly line techniques.

Continuous production is very much harder in industries where the product is heavy and bulky, where the operations to be performed on each piece are complex and diverse, where it is difficult to transfer the product in process from one operation to the next, and where constant adjustments must be made on the operating machines.

What is often needed to make production automatic is not an ingenious new machine, but an ingenious new idea. Any product, no matter how complex in design or construction, can be produced automatically—at a price. But the point is not to make production automatic at all costs; it is to produce goods that are better, or cheaper, or better *and* cheaper.

When the material being processed is not a rigid, solid object but something that flows by its very nature—a liquid, a gas, electric energy, a solid in crushed or powdered form—continuous flow is a good deal easier to achieve. Thus, it is not surprising that automation began earlier and has gone much further in the processing industries than in manufacturing, although even these industries are still a long way from full automation.

The processing industries long ago gave up batch processing for integrated systems, in which materials flow continuously through chambers, processing tanks, and pipes. Now, self-regulating control devices capable of sensing, measuring, comparing, and remembering have begun to carry automation to a new phase; they have taken over many of the controlling and regulating functions formerly performed by men.

In the next few years, automation will clearly have its biggest and most immediate impact not in the factory or in the processing plant, but in the office. Offices, too, process a raw material—information. And as automatic production machines have speeded and improved industrial processes, automatic "white collar" machines in the form of electronic computers have begun to do the same thing for office procedures, with promises of much more to come.

Toward an Economic Study of Automation

Automation, some observers contend, will have more in common with a glacier than a flood. It will go far in the end but, in their view, there is not much chance that it will sweep ahead so fast that it will swamp the economy. There are a number of factors they believe will tend to slow its spread.

- Not everything can be automated. . . . Even those industries that are most ripe for automation will probably never become completely automated. The manless factory is a technical possibility, but there are good reasons for thinking that it will never be built.
- The high cost of automation . . . may well turn out to be the highest hurdle in the path of rapid automation.
- The shortage of technical manpower is a severe limitation on the speedy introduction of automation.
- Automating is a long-term process . . . far more than simply buying an elaborate new machine and plugging it in.

The opinion that automation's progress will be sufficiently slow and restrained so as not to play havoc with the economy is not unanimous.

In this view, the following important indicators discussed below show that the level of automation is fast rising to flood proportions.

- Sales of automation equipment are booming.
- There is some tendency to treat those industries in which automation is not likely to play a major role as if they did not exist at all. Yet it is the total impact of automation on the economy that will count, and even industries not susceptible to a high level of automation will, if they automate at all, make some contribution to the total.
- The disadvantage of expensive equipment may be more than cancelled out by the tremendous savings automation makes possible.

In addition to the broad effects on the overall employment and economic situation, automation will influence the structure of business and the task of management. There are arguments concerning what this effect will be, and, here too, there are hardly any facts to back up either side. The three areas which receive the most attention in this context are the effects of automation on size of business, on competition, and on management.

Will the advent of automation give companies that are already big such an overwhelming advantage that small and medium-sized business will be forced to the wall? Since small business usually does not have either large amounts of money to invest in new plant and equipment, or a volume of production and sales that would justify spending the money even if it were available, it would seem that automation, because of its high costs, might spell the doom of all but the industrial giants.

There are a number of ways in which costs can be brought within the reach of these companies. Rental of capital equipment is already becoming common in the automation fields, particularly in the case of computers.

Moreover, small business, by reason of its greater flexibility and lower overhead, can, as one observer has noted, develop a new product and have it on the market "before the highly automated plant can even draw plans."

On the other hand, true automation does not necessarily mean long runs of standardized products. Technical advances may bring flexibility to some of the larger-scale manufacturing processes. Further, advantages that come with size but are not related to scale of production will continue to assist the large companies. Such advantages include the large company's ability to advertise and make large capital investments.

In an industry where competition is strong, automation is likely to proceed quickly because there is heavy pressure on individual firms to cut their costs. If there is little competition, the pressure for improvements will be less, and automation is likely to be delayed.

Is management ready for its new and increased responsibilities? Automation presents a unique challenge to management not only to perform old tasks better, but also to reach new levels of achievement, and to change further and enhance the role of the professional manager. But even to embark on a program, management must have the imagination, insight, and courage to make sweeping changes that are certain to be expensive.

The most vocal and passionate arguments concern the effects of automation on employment—or unemployment. Mixtures of economic theory, social philosophy, historical determinism, and statistical juggling are used in discussions; but there is still a great shortage of facts.

There is a real fear of automation. Much of it emanates from a failure to understand exactly what automation is; part of it is a genuine reaction to the possibility that one's job will not be in existence tomorrow; and a part of it is generated for political purposes or in order to further particular goals.

The mainstay of fear and confusion is ignorance, and much of the unrest is caused more by uncertainty than by any knowledge that automation will be harmful. Such fear and unrest can give rise to policies and actions that may have a long-term effect on the development and progress of the U.S. economy. All these signs are just further indications of the need to find out the facts.

Plenty of Jobs for Everybody?

Many believe that displacement is not now a serious problem and that it is not likely to become one. Even a highly automated operation needs workers, although they will not be doing the same jobs they did before. And there are good reasons for believing that automation in practice has had more of a tendency to create jobs than to do away with them.

A number of industries making substantial use of automatic machines have not only not laid off any workers, but have hired a large number of new ones. A recent survey by the International Association of Machinists showed that among 346 metalworking plants which had installed some form of automation, total employment had increased. Automation has also created one whole new booming industry—the industry that produces automation equipment.

Some even doubt that any "displaced" labor will develop. The rate at which the labor supply is increasing is not keeping pace with increases in the demand for labor. Presently, the working population is substantially composed of people between the ages of 20 and 65. The age of retirement is dropping and the age of those entering the labor force is rising. These trends and some others indicate that the labor force in 1975 will probably range between 78 and 86 million. The demand for labor will in all probability exceed this supply.

But labor leaders have already announced that their next goal after the guaranteed annual wage will be a four-day work week. If this goal is achieved by 1975, we will need the equivalent of an additional 21 million workers—20 percent more than 84 million—to turn out the volume of goods and services that 84 million workers could produce in a five-day week.

Or, Not Enough Work to Go Around?

On the other hand, those who point out the dangers of automation are deeply concerned that over the next five to ten years, when they expect the great changes of automation to come, there will be a surplus not of jobs but of job-seekers.

Unemployment figures would seem to indicate that no large number of workers has yet been displaced by automation. Yet at least one observer, Warner Bloomberg, Jr. of the University of Chicago, has suggested that even these low figures can make a considerable amount of displacement. He believes that even today "an uncounted number of industrial and office workers—more than likely going in the hundreds of thousands—are 'temporarily out of work' because the devices of the new technology have taken over their functions." Since there is no real difficulty in most areas of finding some kind of job, they take what they can get and are no longer unemployed.

And though there have been no mass layoffs because of automation, there is concern in some quarters that jobs are vanishing. "The worker displaced is not fired," Professor Walter S. Buckingham of the Georgia Institute of Technology has said, "he is the one who is not hired."

Arguments and counterarguments do not provide the answers. The tenacity with which the beliefs are held, and the energy with which the viewpoints are pressed, make it imeperative that some factual basis for judgment be obtained. This must be done before national policy is set on the basis of any theory or set of assumptions.

I think it is encouraging that industry itself is alert to the problem and to its responsibilities. It is also encouraging that other institutions have begun to take steps to train both those who are already in the working force and those who will one day join it for the new jobs that automation creates. Workers will not automatically fit into the new jobs. Unskilled workers, workers with specialized

skills whose jobs have been taken over by machines, and older workers who have spent a working lifetime in a job only to find their skills made obsolete overnight, all have to be retrained.

The Social Consequences

The questions automation raises for society as a whole go far beyond the problems of what it will mean for industry and labor.

In our capacity as consumers, we will probably find that many of the things we buy will be cheaper and of better quality. Will they also be more standardized?

More important is the question of increasing leisure. Automation, many observers believe, will soon give us a choice between added products and comforts and added leisure. If we choose leisure, it is entirely possible that the three-day weekend, or the three-month vacation, will be a reality within the next decade.

But sooner or later, it is clear, we shall have to face the question: Are we capable of developing a culture that does not depend on work to give meaning to our lives? And this question, in turn, raises another that perhaps in the end will turn out to be the most important of all: How shall we go about educating ourselves for an age of automation? On all levels of working and living we will need more education. We are still drawing heavily on the knowledge and the trained personnel developed under the pressure of military needs. But we cannot go on living off our hump indefinitely. We will have to develop ways of making higher training available to those best suited to make good use of it.

The Search for Solutions

Here is a summary of some of the arguments most generally used by those who consider automation a blessing rather than a menace.

- Automation is nothing new, so there is no reason for concern.
- Everything will work out in the long run. The natural forces in the economy will make whatever adjustments may be necessary to the introduction of automation.
- Automation is the key to a shorter work week.
- Unlimited demand for goods and services will prevent unemployment from automation.
- Automation will create a bigger pie, so that everybody's slice will be larger.
- Automation will come slowly and in limited quantity. It is neither big enough nor fast enough to warrant concern.
- Automation is the only means of maintaining our standard of living in the face of a significant labor shortage.
- Employment has been increasing. While everybody is shouting about the harmful effects of automation on employment, there has been a steady increase in employment

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—The People of NPA—

T. G. MacGowan

Widely known as a speaker and writer on marketing and business economics, Mr. T. G. MacGowan, charter member of NPA's Business Committee, and member of NPA's International Committee, is also an authority on sales forecasting. Mr. MacGowan received his early training in journalism and at one time was the publisher of the National Automobile Forecasting Service. In 1931, he became production manager and later general manager for Walter Mann and Staff, New York marketing research corporation. In 1935, he became president of Facts, Incorporated, also a New York marketing research company. Since 1939, Mr. MacGowan has been associated with the Firestone Tire & Rubber Company, serving as their manager of Marketing Research for 18 years, and as chairman of the Post-War Planning Committee during World War II. In 1956, he became Director of Advance Planning. An active member of the American Marketing Association, Mr. MacGowan has served as their president 1954-55, operational vice-president 1951-52, national director 1946-47, and chairman and member of various national committees. Mr. MacGowan has received several honors for his work in market analysis. In June 1946 he was awarded a Meritorious Service Citation from the New York Chapter of the American Marketing Association for his work with the CED. In June 1949, he received from the American Marketing Association one of its first National Awards for the Firestone study, "Techniques for the Study and Analysis of Retail and Wholesale Prices." In October 1953, he was named by the Boston Conference on Distribution for its Hall of Fame. Mr. MacGowan compiled estimates of postwar markets in hundreds of industrial classifications, and as a result charted the probable course of postwar employment in America. The report presenting these findings, "American Industry Looks Ahead," was one of the few studies which definitely predicted that there would be no serious postwar transitional unemployment and that there would be a high and rising level of employment after the war.

Experiments and Potential Applications of Solar Energy

With present day demands for power ever increasing, man's quest for energy resources has turned toward research for methods of utilizing a readily available source of energy—the sun. Reporting on the research made in the field of solar energy, two recent periodicals, *The UNESCO Courier,* and the *French Economic and Technical Bulletin* report on recent experiments and the potential applications which are being made throughout the world.

The *Bulletin* points out that solar energy is frequently intercepted by clouds so that only a small amount, diffused in all directions, reaches the soil. Even so, adds the *Bulletin,* in the solar belt—the territory which extends approximately to the 40th parallels north and south—radiation is available 200 to 300 days each year. This area includes the southern United States, Central and South America, the West Indies, the most southern regions of Europe, the Near East, Africa, and the southern half of Asia.

The two processes used to collect the energy of the sun most efficiently, as reported by the *Bulletin* are: direct collection without concentration of energy; and collection and concentration of sun power.

Direct collection, as defined by the *Bulletin*, is based on the knowledge that different substances react in different manners to solar rays. Some, such as transparent bodies, are traversed, others reflect, while remaining unaffected themselves, and a third group absorbs the rays, which heat the substance up in the process. Greater radiation retention is obtained through the principle known as the "glass-house effect," in which the absorbent bodies receive the rays through glass shields which act as reflectors. The rise in temperature, points out the *Bulletin,* can be further improved by superimposing "several of these one-way glass shields and by utilizing a group of so-called selective bodies which absorb the solar rays very well but give off very little radiation themselves." This process can be utilized for heating and distilling water, heating dwellings, drying fruits, and other similar services.

Collection and concentration of sun power, the other method, consists of focusing the solar radiation by two possible optical means—lenses or reflectors. The use of lenses has been abandoned in favor of the less expensive reflectors.

Production of hot water by solar radiation, an economically feasible process, is being used in the United States, Morocco, and even in Southern France, points out the *Bulletin. The Courier* reports that one Paris firm, after installing small individual hot water heaters in France, Africa, Australia, and various other parts of the world, has begun work on large scale installations. It has already installed a 372 gallon heater in the Moroccan tobacco factory in Casablanca and is now working on plans for a huge solar energy unit designed to supply hot water to 205 apartments in a new housing development at Koubra, near Algiers, with a capacity of 11,000 gallons, if present plans are adopted.

The production of distilled water is another project of paramount importance in arid regions notes the *Bulletin.* In these areas, available water supplies—which generally exist close to the surface—cannot be utilized for cultivation because evaporation deposits mineral salts on top of the soil, states the *Bulletin.* Truck drivers in the Sahara, points out *The Courier* often pay $.25 a quart for distilled water for their radiators because ordinary Sahara water contains too many minerals.

The principle of solar radiation used to distill water as explained by the *Bulletin,* consists of heating the water by solar radiation in a shielded black tank where the shielding serves to reduce the heat losses. The water vapor then condenses on the glass shielding which is cooled by the air and its own radiation. Although the cost of this water is still too high for use in cultivation, it does constitute a means of producing potable water for man.

In order to economically justify the production of distilled water, Professor Felix Trombe, Director of the Mont-Louis Solar Energy Laboratory in France and his Assistant Director, Marc Foex, have developed a method for raising plants in "solar glasshouses" which are equipped with distilling installations. These distilling greenhouses lend themselves very well to the production of a variety of plants useful to man and impossible to raise in the open air in the arid regions, observes the *Bulletin.*

An illustration of a popular use of solar energy is pointed out by *The Courier.* The "silicon photovoltaic cell" —more commonly known as a solar battery—was developed by the Bell Telephone Company several years ago. The two main uses of the battery are for transistor radios, lightning beacons, buoys, and other aids to navigation. The main advantage of the battery is that it requires very little maintenance. Each cell, when exposed to sunlight, converts 8 to 14 percent of the sun's energy into electricity —a very high rate of efficiency. This electricity is then fed into an ordinary storage battery to run the beacon or radio at night.

In conclusion, *The Courier* cautions that there is no sudden era of solar prosperty around the corner. As the Unesco Advisory Committee on Arid Zone Research recently reported: "Utilization of solar energy holds great promise for the arid zones of the world, but an immense amount of patient and diligent research is still needed."

(*French Economic and Technical Bulletin,* published by the Economic Section of the French Embassy, Washington, D. C.: No. 3, 1959, 28 pp., and *The UNESCO Courier,* UNESCO Publications Center, New York: September 1958, 34 pp. 30¢ per issue.)

Two New Books on

Economic Forecasting

In Leonard Silk's article, "Business Forecasting: Is It Really Getting Any Better?" which appeared in the April issue of Looking Ahead, Mr. Silk stated "we are in a period of re-evaluation of the forecasting methods and approaches developed in the past two decades. This process of brutally objective criticism to expose past failures and to point up past successes is a necessary precondition for fresh advances."

Business Conditions Analysis, by John R. Lewis and *Economic Forecasting,* by V. Lewis Bassie, are the result of such re-evaluation. Both books are written in the conviction that economic forecasting is a necessity for the guidance of business executives and other public and private decision makers but that we have to learn from past failures. Both recognize that a high degree of uncertainty is an inherent characteristic of our economic system, and that no economic forecasting by any one "naive" forecasting method is possible.

The always present uncertainty is, however, no argument against the practical usefulness of economic analysis. Decision making under conditions of well understood and quantitatively appraised uncertainties is not the same as blind decision making under conditions of ignorance. In other words, taking calculated risks is not the same as gambling.

Bassie castigates rightly the economic forecasters who always try to "play it safe," or "straddle." There is, however, little value in the "heroic" attitude of a forecaster who closes his eyes to the uncertainties of the situation and makes an unqualified forecast, hoping for the best—or for the worst if he has made a bearish forecast. This basic attitude is shared by both authors, although I feel that Bassie appears to defend a bit too much the "sticking one's neck out" attitude of the forecaster. Lewis emphasizes more the effect of economic analysis on private behavior and government policies, while Bassie, in my opinion, pays too little attention to these "feedback" effects.

Both authors agree on the basic approach. They are skeptical of forecasting by rigorous mathematical formulae, and positive toward using national economic accounts as one of the important frames of reference for forecasting. Both authors subscribe to methods which use past relationships by econometric measurements, but also believe in using a good deal of common sense judgment. Lewis calls this method "opportunistic model building." Bassie speaks of "flexible statistical analysis." Also, both authors deal with forecasting for activities in various specific sectors of the economy as well as with forecasting the overall economic development.

Bassie's book is entirely devoted to economic forecasting with the main emphasis on short and intermediate range. He recognizes that good economic forecasting must be based on good economic analysis—that is, an understanding of the way our economy works. The economic analysis is, however, not explicitly treated in his work. Lewis, on the contrary, devotes more than one half of his space to economic analysis and also treats long-range projections in a special part. Thus, Lewis' book covers a wider range of topics and is more suitable for the novice in forecasting and especially for classroom use. It is highly readable and didactic. Bassie's book goes somewhat deeper into the technical statistical problems and may be more suitable for the practitioner of economic forecasting, who already has a fair degree of general economic training. Thus, both works supplement each other, and mark the "precondition for fresh advances" in economic analysis which Mr. Silk calls for.

Gerhard Colm

(*Business Conditions Analysis,* John P. Lewis, McGraw-Hill Book Company, New York: 1959, 614 pp. $8.25, and *Economic Forecasting,* V. Lewis Bassie, McGraw-Hill Book Company, New York: 1958, 712 pp. $8.75.)

Organizational Performance

A bibliography, *Measurement and Evaluation of Organizational Performance,* has just been published by the Graduate School of Business and Public Administration of the Cornell University. The author, Paul Wasserman points out that one of the important problems facing modern organizations is finding an appropriate means of evaluating accomplishment. While a wealth of published material on this subject exists, few attempts are made to obtain this literature because of a lack of a reference source. Noting this fact, Mr. Wasserman states that the objective of the bibliography is to provide a systematic reference source in which these contributions would be logically arranged and classified. Subjects covered include: general and theoretical material on measurement and evaluation; and measurement of the total enterprise, functional units of organization, and individual performance. Also included is an author index.

(*Measurement and Evaluation of Organizational Performance,* Paul Wasserman, Graduate School of Business and Public Administration, Ithaca: 1959, 120 pp. $3.75.)

World-Wide Science and Education Programs

In 1959, UNESCO began a two-year program with the largest budget—nearly $26 million—in its 12 year history. Under a mandate from its 81 member states, UNESCO will concentrate its resources on priority needs in education, science, and culture, reports *The UNESCO Courier.*

Out of the total budget, the highest expenditure is for education. The budget for the regular program of the education department is $3,871,000. Combining this amount with the expenditures for the Technical Assistance Program and the primary education project in Latin America, the total reserved for educational projects in 1959/60 is more than $8.5 million, states *The Courier.*

Foremost among examples of UNESCO's programs are the three "major projects" first approved two years ago by the General Conference in New Delhi. These projects aim at expanding primary education in Latin America, bringing scientific research to the aid of the arid lands in the dry belt running from North Africa through the Middle East to South Asia, and promoting mutual appreciation of the cultural values of the Orient and the Occident.

Other projects of the UNESCO 1959-60 program noted by *The Courier* are: awards of fellowships totalling $1,274,000 to artists, writers, musicians, teachers of journalism, and others in similar fields; aid to member states in setting up a regional mathematics center in Latin America, libraries in Africa, and aid to research in nuclear physics, the marine sciences, and electronic brains; and assistance in the preservation of works of art.

Coupons Cut Red Tape

In December of 1948, the UNESCO Coupon Scheme, to help cut the red tape of currency exchange restrictions with regard to books and periodicals, was launched. This Coupon Scheme, controlled by 81 member states of UNESCO, involves a multi-million dollar international business device to aid foreign countries with a limited amount of foreign capital to purchase educational material with their own currency.

Previous to 1948, all applications for books and periodicals were considered along with the requests for other products such as foodstuffs, raw materials, and machinery, for a share of available foreign currency. Now, the governments of 22 UNESCO member states have agreed to the distribution of UNESCO Coupons for which they pay the Organization in dollars, French francs, pounds sterling, or other monies which UNESCO can use in carrying out its work. Designated distributing bodies then sell the Coupons for local currencies, reports *The Courier.*

In 1950, the Coupons were extended to include the purchase of educational films and scientific materials, and four years later, the scheme was further extended to include educational and cultural travel.

Whether used for buying a pocket dictionary, Geiger counter, a film on mathematics or a foreign study tour, concludes *The Courier,* UNESCO Coupons are giving practical assistance to the development of education, science, and culture around the world.

(*The UNESCO Courier,* UNESCO Publications Center, New York: January 1959, 34 pp., 30¢ per issue.)

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in the past few years during which the impact of automation should have been at its highest.

- Automation brings about lower prices.
- A more responsible management will not permit automation to have harmful effects on employment.
- Development and growth may occasionally mean hardship, but it is a small price to pay for progress.
- The growth of the automation industry itself will provide employment for a good number of those put out of work by the products of the automation industry.
- Automation is the key to national survival. The only way that the United States will be able to stay ahead of, or keep pace with, Russia is through a strenuous increase in productivity.
- Automation will bring economic stability. In an automated plant, labor costs will be so low and capital costs so high that it will pay to continue production and lower prices rather than to cut production and lay people off.

The more common arguments for concern over automation are indicated below.

- Automation is an accelerating phenomenon.
- The boom has helped up to now. The advent of automation—which is still in its infancy—has been accompanied by the greatest period of boom that America has ever experienced.
- There will be no purchasing power. As automation replaces workers and permits the manufacture of products without labor, these workers will be unemployed.
- The growth of job opportunities cannot grow as fast as necessary.
- Markets will become saturated.
- Automation means the subjugation of man by the machine.

It is evident that at this stage one can do no more than raise questions, even on . . . relatively limited areas of economics. There are a great many others that have to be considered, such as automation and international trade, interrelationships between automation and the distribution of the national income, and the effects of automation on the structure of the firm and the economy.

But information gathering is not enough; we must also know what the facts mean. At the present time we do not even have the information, and the first step toward a constructive attitude—and program—for automation is to find out these facts. There is no getting away from

Looking Ahead

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that. But we must also think about a means of evaluating the data and interpreting them once they are found.

It is illusory to think that the most thorough conventional type of investigation of the "truth about automation" will give enough information for an unequivocal answer to all the questions raised by automation. We would not obtain this even if the investigation were carried out by an unbiased group, and if the interested parties were to agree to accept the findings of such a group.

A thorough study is needed. It is needed in order to unearth sufficient knowledge on which to make better decisions; but before this knowledge can be of constructive use, we must develop tools with which to interpret the facts to deduce reality from the necessarily incomplete facts that will exist. In other words, we need a way of thinking, a framework in which to interpret the facts. Part of this is provided by current economic theory; part of it must be developed so as to apply the best techniques of economics to the specific problem of automation. Developing these lines of thought is a study in itself. It is something that should be done alongside any project on the economic and social consequences of automation.

(Automation: Its Impact on Business and Labor, John Diebold, National Planning Association, Washington, D. C.: 1959, 74 pp. $1.00.)

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1606 New Hampshire Ave., N.W., Washington 9, D. C.
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